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Report to the Chairman, Subcommittee on Environment, Committee on Science, Space, and Technology, House of Representatives

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ENERGY POLICY

Options to Reduce Environmental and Other Costs of Gasoline Consumption

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The Honorable James Scheuer
Chairman, Subcommittee on Environment
Committee on Science, Space, and
Technology
House of Representatives

Dear Mr. Chairman:

As requested on July 24, 1991, this report examines policy options to address the environmental and other costs of energy use by automobiles and light trucks, costs that are not included in the price at the gasoline pump.

We will send copies of this report to the appropriate congressional committees; the Administrator, Environmental Protection Agency; and the Secretary of Energy. We will also make copies available to others on request.

Please contact me at (202) 275-1441 if you or your staff have any questions. Major contributors to this report are listed in appendix I.

Sincerely yours,

Victor S. Rezendes
Director, Energy and Science Issues

Executive Summary

Purpose

Gasoline consumption by passenger cars and light trucks is a major source of air pollution. It also adds to the economy's dependence on petroleum and vulnerability to oil price shocks. Despite these environmental and other costs, called external costs, the price of gasoline, adjusted for inflation, has generally been declining since 1985, encouraging increased consumption.

With these concerns in mind, the Chairman, Subcommittee on Environment, House Committee on Science, Space, and Technology, requested that GAO assess policy options for addressing the external costs of gasoline consumption. To do this, GAO identified six major policy options and evaluated whether they addressed several relevant objectives, including economic growth, environmental quality, equity, petroleum conservation, visibility of costs, energy security, traffic congestion, competitiveness, and administrative feasibility.

Background

Many economists believe that the price of gasoline does not sufficiently reflect the external costs of gasoline consumption. The Council of Economic Advisors reported to the President last year that national security and environmental considerations are given inadequate weight by the private market forces that determine energy prices. The National Academy of Sciences suggested a policy of increasing fuel prices to internalize associated costs and provide a market signal "to channel consumer behavior in a direction consistent with societal objectives."

The six policy options GAO evaluated were the following: a higher gasoline tax, a tax on vehicles' tailpipe emissions, subsidies for alternative fuels, higher fuel economy standards for new vehicles, a fee-rebate program whereby consumers receive a rebate for the purchase of new vehicles that operate more efficiently and pollute less and pay a surcharge for the purchase of vehicles that are less fuel-efficient and pollute more, and a program that financially rewards people who voluntarily scrap older vehicles.

Results in Brief

The six options GAO reviewed could all reduce the nation's dependence on oil. In addition, all of these options could reduce air pollution resulting from gasoline consumption. However, no option would satisfy all of the policy objectives considered, although two options—a higher gasoline tax and a tailpipe emissions tax—would address more objectives than others. On the other hand, both of these taxes could lead to slower economic

growth and place a disproportionate financial burden on low-income and rural populations. Similarly, while a fee-rebate program could increase consumer demand for fuel-efficient new vehicles, this option would not reduce gasoline consumption and air pollution from older vehicles.

While all policy options would involve trade-offs in meeting various goals, they could be modified or combined to better address the external costs of gasoline consumption and other policy objectives. For example, revenues from a higher gasoline tax or a tailpipe emissions tax could be used to reduce other taxes, such as taxes on income, and possibly offset negative impacts on economic growth and low-income and rural groups. Similarly, a fee-rebate program could be combined with an old-vehicle scrappage program to improve fuel efficiency and reduce air pollution from both new and old vehicles.

GAO's Analysis

Policy Options Involve Trade-Offs

The policy options GAO reviewed vary in how well they address the external costs of gasoline consumption and other important policy objectives. Choosing among the options involves trade-offs.

A higher gasoline tax could encourage drivers to reduce gasoline consumption by driving less and at lower speeds, maintaining their vehicles better, commuting to work in car pools or by mass transit, or purchasing more fuel-efficient vehicles. This, in turn, would reduce the nation's dependence on oil, relieve highway congestion, and decrease emissions of gases that pollute the air. However, a higher gasoline tax could slow economic growth. Moreover, because the tax would constitute a larger portion of the income of low-income groups, it would disproportionately affect that population.

A tax on emissions from vehicles' tailpipes offers similar advantages and disadvantages. In addition, though, this tax could be more cost-effective than the gasoline tax because it could reduce the emissions from and the miles traveled by the most polluting vehicles. However, a tailpipe emissions tax could be hard to administer because of the complexities involved in measuring emissions.

Subsidies for alternative fuels would again reduce gasoline consumption, but whether they would necessarily lead to cleaner air is uncertain. The combustion of some alternative fuels—for example, compressed natural gas and methanol—may reduce carbon monoxide and hydrocarbon emissions but may not significantly reduce nitrogen oxide emissions (NOx).

Raising corporate average fuel economy (CAFE) standards—which now require that new vehicles from each manufacturer's stock meet an average fuel economy of 27.5 miles per gallon—should reduce gasoline use, though only in new vehicles. However, if gasoline prices remain low, consumers might have less incentive to buy the more fuel-efficient vehicles required under the standards and instead might hold on to their older, less fuel-efficient, more polluting vehicles. Consumers who do buy such vehicles may drive more because of the lower operating costs resulting from increased fuel efficiency. This, in turn, could increase highway congestion and offset some gasoline savings and emissions reductions achieved by the standards. Higher CAFE standards could impose greater costs on manufacturers, especially those that produce a full line of vehicles.

A fee-rebate program would encourage consumers to purchase more fuel-efficient, less polluting vehicles, since the rebate would, in effect, lower the cost of these vehicles. Such an option might help create demand for fuel-efficient vehicles, especially if gasoline prices were low. However, this policy option would not affect fuel consumption and emissions from older vehicles. Nor would it motivate people to drive less or maintain their vehicles properly.

Programs to remove older vehicles from the road would target some of the worst polluting and most fuel-inefficient vehicles. But these programs would do nothing to improve fuel economy or reduce the emissions of newer vehicles. If more older vehicles were retired, fewer would be available for resale, and the price of used cars would rise. This would disproportionately affect low-income people, who typically purchase older vehicles.

Policy Options Can Be Modified or Combined for Maximum Effectiveness

Although every policy choice would involve trade-offs, ways exist to improve the effectiveness of many of these options. In particular, individual policies could be modified to avoid some trade-offs. For example, policies that impose taxes—on gasoline or emissions—could be structured to reduce any negative effects on the economy by "recycling"

the tax revenues to reduce payroll or income taxes and by phasing them in gradually. Disproportionate impacts on low-income groups could also be addressed by recycling revenues.

If higher CAFE standards were set, manufacturers might be allowed to trade credits to reduce the costs of meeting the standards. Manufacturers of larger, less fuel-efficient vehicles could benefit from purchasing CAFE credits from other manufacturers, if buying these credits was less expensive than meeting the standards.

The tailpipe emissions tax could be easier to administer if new technology were used to measure emissions. Technology has been developed that can test vehicles under a wide range of operating conditions and detect more pollutants. Enforcement, too, could be enhanced if remote sensing devices were used to spot-check emissions between regular inspections.

Policies could also be combined to meet as many policy objectives as possible. For example, alternative fuel subsidies could be more effective in reducing air pollution if they were combined with a tailpipe emissions tax. This approach could increase the costs of using those alternative fuels with the worst emissions characteristics and encourage consumers to purchase cleaner fuels and the vehicles that use them. If such vehicles were not commercially available (e.g., electric vehicles), demand for them could increase, further motivating private industry to develop them.

Higher CAFE standards could be combined with a fee-rebate program or a higher gasoline tax to increase consumer demand for fuel-efficient vehicles. The financial incentives provided by the fee-rebate program and the tax would encourage more consumers to purchase the fuel-efficient vehicles required by CAFE standards. A vehicle scrappage and fee-rebate program combined would be more effective than either implemented alone, reducing gasoline consumption and emissions from both old and new vehicles.

Agency Comments

GAO discussed its analysis with officials from the Department of Energy's Office of Policy and Planning, Office of Conservation and Renewable Energy, and Energy Information Administration and with the Environmental Protection Agency's Office of Mobile Sources and Office of Policy Planning and Evaluation. They generally agreed with the information presented. As requested, GAO did not obtain written comments from these agencies.

Contents

Tables

Figures

Abbreviations

CAFE	Corporate Average Fuel Economy
CARB	California Air Resources Board
CO2	carbon dioxide
CO	carbon monoxide
CNG	compressed natural gas
DOE	Department of Energy
EPA	Environmental Protection Agency
EPCA	Energy Policy and Conservation Act
GAO	General Accounting Office
HCHO	formaldehyde
NHTSA	National Highway Traffic Safety Administration
NOx	nitrogen oxides
NES	National Energy Strategy
PAN	peroxyacetyl nitrate
R&D	research and development

Introduction

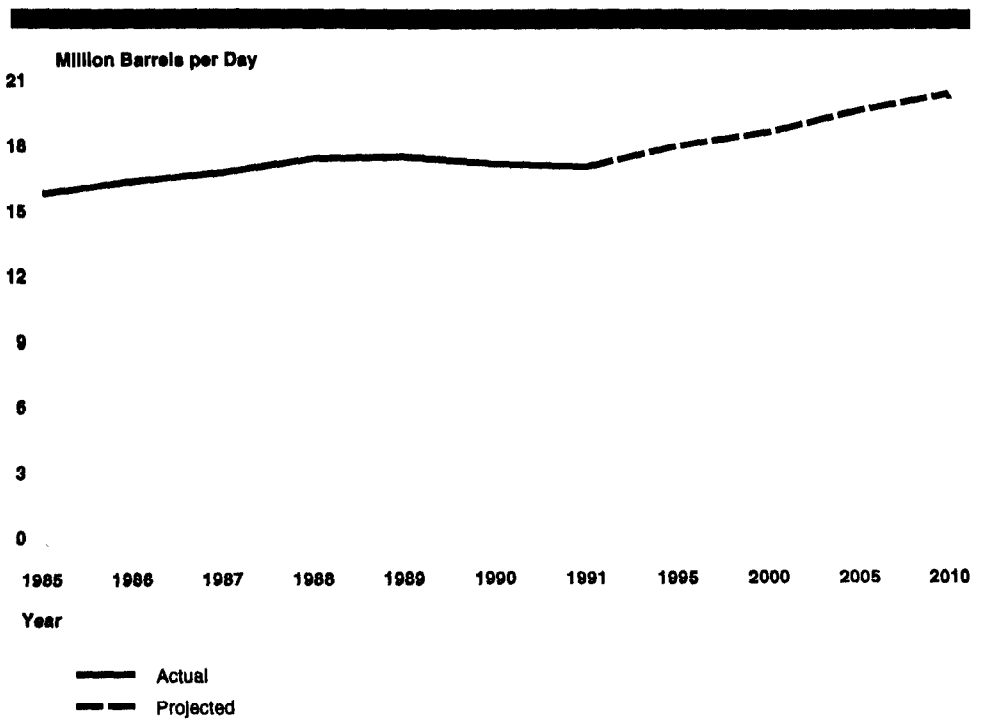
Prices of oil and gasoline have generally been declining since 1985; adjusted for inflation, the price of gasoline in the United States is lower now than in 1947. As prices have fallen, consumption of oil and gasoline in the United States has increased. These low prices do not include all the costs associated with consuming petroleum products, often termed "external costs." For example, gasoline consumption contributes significantly to air pollution. Extensive gasoline use may also increase the economy's vulnerability to sudden increases in oil prices.

Low Oil and Gasoline Prices Have Led to Increased Consumption

Consumers respond to low oil prices by consuming more oil and gasoline. For example, after oil prices declined in 1986 to almost half their previous level, average daily oil consumption in the United States increased by 550,000 barrels to its highest level in 5 years. Relatively low oil prices, along with other factors such as higher economic growth, contributed to a steady increase in U.S. oil consumption between 1986 and 1989. Consumption fell in 1990 because of higher oil prices triggered by the Persian Gulf War; it fell again in 1991 in response to the economic recession. But despite these temporary reductions, overall, the United States used about 16.7 million barrels of oil per day in 1991, compared to 15.7 in 1985. The Energy Information Administration (EIA) expects oil consumption to increase to nearly 20 million barrels per day in 2010.[1] Figure 1.1 depicts actual and projected U.S. oil consumption from 1985 through 2010.

[1]1992 Annual Energy Outlook With Projections to 2010, EIA, Department of Energy, Washington, D.C., January 1992, p. 72. Data are from the Reference Case forecast, which assumes that oil prices will increase to 33.40 dollars per barrel by 2010.

Figure 1.1: U.S. Oil Consumption, 1985-2010



Source: Energy Information Administration.

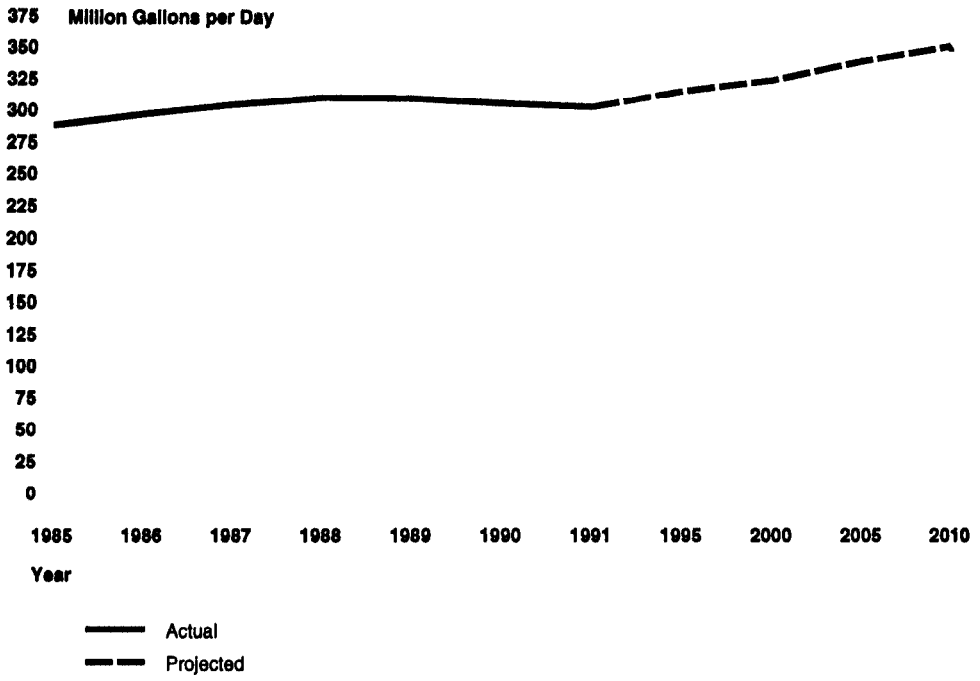
The current price of gasoline, adjusted for inflation, is lower now than it was in 1947 and is significantly lower than the retail price paid in most other industrialized nations. This low price has contributed to increased use of gasoline by light-duty vehicles—passenger cars and light trucks. For example, vehicle miles traveled by passenger cars and light trucks increased by 14 percent between 1985 and 1991. As a result, in 1991 the United States used gasoline at a rate of about 301 million gallons per day, compared to about 287 million in 1985.

Consumption of gasoline will likely continue to increase because expected growth in both the population and the economy will increase the demand for travel. EIA, for example, projects that travel by light-duty vehicles will increase at an average annual rate of 1.7 percent between 1990 and 2010.[2] As a result, EIA expects U.S. gasoline consumption to reach about 349 million gallons per day in 2010. Figures 1.2 and 1.3 portray actual and

[2]EIA's 1992 Annual Energy Outlook, p. 78.

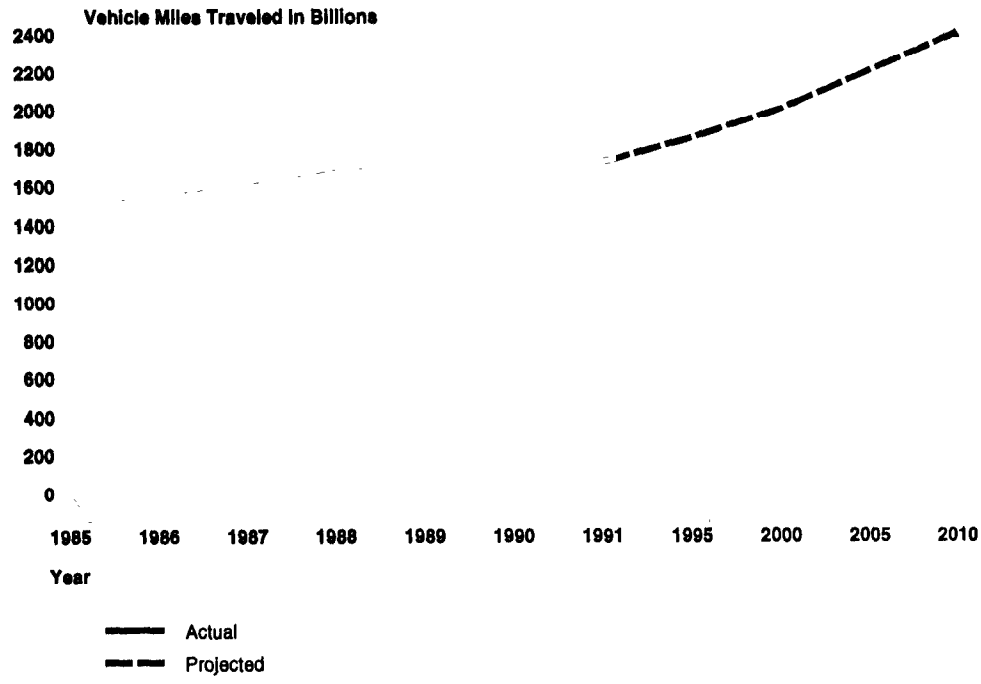
projected U.S. gasoline consumption and vehicle miles traveled for 1985-2010, respectively.

Figure 1.2: U.S. Gasoline Consumption, 1985-2010



Source: Energy Information Administration.

Figure 1.3: Miles Traveled by Light-duty Vehicles, 1985-2010



Source: Energy Information Administration.

Gasoline Prices Do Not Reflect External Costs of Gasoline Use

The current low price of gasoline does not include all external costs associated with gasoline use, such as the costs associated with the health and environmental impacts of air pollution. In addition, greenhouse gas emissions from gasoline use contribute to the potential for global warming, which could have environmental and economic costs. Further, according to some economists, the current price of gasoline does not include the economic costs that may result from the nation's vulnerability to oil price shocks.

Pollution and Global Warming

Light-duty vehicles fueled by gasoline emit carbon monoxide, hydrocarbons, and nitrogen oxides (NOx). In 1987, for example, these vehicles accounted for about 45 percent of hydrocarbon and NOx emissions and about 80 percent of carbon monoxide emissions in U.S. urban areas.

These compounds present a health hazard. Elevated levels of carbon monoxide can affect persons who suffer from cardiovascular disease.

Hydrocarbons, NOx, and other trace gases interact in the presence of sunlight to form tropospheric ozone, or smog, which can cause adverse health effects, particularly for people with respiratory ailments. As of October 1991, 98 metropolitan areas, with a total population of 140 million people, did not meet ozone air quality standards set by the Clean Air Act; 42 areas did not meet carbon monoxide standards.

Light-duty vehicles also contribute about one-fifth of total U.S. emissions of carbon dioxide, which is a major greenhouse gas. Each gallon of gasoline burned by light-duty vehicles emits about 20 pounds of carbon dioxide.

Scientists and policy makers are concerned about greenhouse gases because, by trapping infrared radiation from the sun, they may increase the temperature of the earth. Some research indicates that this temperature change could alter major ocean currents, which in turn could lead to changed weather patterns and higher sea levels. According to a 1991 study by the National Academy of Sciences, "even given the considerable uncertainties in our knowledge of the relevant phenomena, greenhouse warming poses a potential threat sufficient to merit prompt responses."[3]

Vulnerability to Oil Price Shocks

Besides damaging the environment, heavy gasoline consumption by light-duty vehicles increases the economy's vulnerability to sudden increases in the price of oil (oil price shocks) because of disruptions in its supply. The economy is especially vulnerable to the effects of a price shock because the transportation sector relies on petroleum for 97 percent of its energy use. Light-duty vehicles alone account for about two-thirds of the transportation sector's petroleum consumption and about 40 percent of all U.S. petroleum use.

However, not all economists agree that vulnerability to oil price shocks is an external cost of petroleum consumption. Some economists argue that market prices do reflect oil price instability. In addition, some economists question the extent to which the oil price shocks in 1973-74 and 1979 led to economic recessions in industrialized countries, including the United States. One study suggests that the declines in these countries' gross national product following these oil price shocks were more likely caused by monetary policies instituted during and after the shocks. This study points out that most countries were already combatting inflation when the

[3]Policy Implications of Greenhouse Warming, National Academy Press, Washington, D.C., 1991, p. 67.

oil price shocks occurred and that their economies were in a cyclical downturn.

There is widespread concern that market prices for petroleum and gasoline do not fully reflect the external costs of energy use. The Council of Economic Advisors reported to the President last year that national security and environmental considerations play little role in the private market forces that determine energy prices. Similarly, the National Academy of Sciences recently suggested that an increase in fuel costs be considered because it would internalize the costs associated with fuel use and provide a market signal "to channel consumer behavior in a direction consistent with societal objectives."[4] While developing the President's 1991 National Energy Strategy (NES), the Secretary of Energy's Advisory Board expressed concern about energy prices. The Board cautioned that if the nation's energy policy was going to rely on market forces to determine energy choices, it needed to ensure that all the costs of energy production and use were reflected in market prices.

While calling for measures to incorporate the external costs of gasoline consumption, participants in recent policy debates have also voiced concern that these measures not unduly burden the economy. For example, the 1991 NES specified as its objective

> achieving balance among our increasing need for energy at reasonable prices, our commitment to a safer, healthier environment, our determination to maintain an economy second to none, and our goal to reduce dependence by ourselves and our friends and allies on potentially unreliable energy suppliers.

Objectives, Scope, and Methodology

At the request of the Chairman, Subcommittee on Environment, House Committee on Science, Space, and Technology, we assessed the ability of various policy options to address the external costs of gasoline consumption by light-duty vehicles and to meet other important policy objectives.

We identified relevant policy options by searching the literature, reviewing legislative proposals, and interviewing Department of Energy (DOE) and Environmental Protection Agency (EPA) officials. We identified the following policy objectives by reviewing major legislation, policy reports, and the relevant literature and by interviewing government officials:

[4]Automotive Fuel Economy: How Far Should We Go?, National Academy Press, Washington, D.C., 1992, p. 11.

- Environmental quality. Progress toward meeting this objective was measured as (1) reduced emissions of pollutants that contribute to air pollution from new and old vehicles, (2) greater reductions in the more harmful pollutants in a cost-effective manner, and (3) increased research and development (R&D) in less polluting alternative fuels and/or vehicles.
- Petroleum conservation. Progress toward meeting this objective was measured as (1) less gasoline consumed in new and old vehicles, (2) more use of mass transit, (3) more use of alternative fuels, and (4) increased research and development in ways to reduce gasoline consumption.
- Energy security. Progress toward meeting this objective was measured as reduced dependence on oil.
- Congestion. Progress toward meeting this objective was measured as relief from highway congestion.
- Equity. Progress toward meeting this objective was measured as no disproportionate costs imposed on individuals in low-income groups or in rural areas.
- Economic growth. Progress toward meeting this objective was measured as no slowdown in economic growth.
- Competitiveness. Progress toward meeting this objective was measured as no additional costs imposed on domestic firms relative to similar firms in other countries.
- Visibility. Progress toward meeting this objective was measured as costs that are visible to consumers.
- Administrative feasibility. Progress toward meeting this objective was measured as no large increase in administrative difficulty.

By extensively reviewing the economic and energy policy literature and interviewing experts, we assessed the merits of each policy option in addressing external costs and the other policy objectives described above, comparing each option against the status quo.The status quo was defined as existing energy, environmental, and transportation policy, including the 1990 Clean Air Act Amendments, current fuel economy standards, and incentives under the Alternative Motor Fuels Act of 1988. We assumed that gasoline prices would remain relatively low.

Our evaluation was limited in several respects. We did not quantify the degree to which each policy option would meet or fail to meet the policy objectives. We assumed that all policy objectives were of equal weight (one policy objective was no more important than another). However, policy makers may decide that meeting some objectives is more important than meeting others when considering the desirability of the options. We also did not assess how the policy options would affect heavy-duty

vehicles (for example, diesel-powered trucks) or other sectors of the economy (for example, the coal industry).

We conducted our analysis from July 1991 through September 1992 in accordance with generally accepted government auditing standards. We discussed the results of this analysis with DOE's Offices of Policy and Planning and Conservation and Renewable Energy, and the Energy Information Administration and with EPA's Offices of Mobile Sources, and Policy Planning and Evaluation. These officials generally agreed with the analysis although they did provide technical comments, which have been incorporated where appropriate. As requested, we did not obtain written comments from DOE and EPA on a draft of this report.

Existing and Proposed Policy Options Addressing External Costs of Gasoline Consumption

Federal laws have existed since the 1960s to address the external costs of gasoline consumption. Under the 1965 Amendments to the Clean Air Act, the federal government regulates emissions from vehicles' tailpipes. Amendments to the act in 1970 and later made these emissions standards increasingly more stringent. The Energy Policy and Conservation Act of 1975 required each manufacturer's stock of new car models to meet an average fuel economy standard. The Energy Tax Act of 1978 established the "gas guzzler" tax on the most fuel-inefficient vehicles. Despite these efforts, air pollution and heavy reliance on oil continue to be problems. As a result, both the federal government and the states are considering, or have already adopted, other policy options. These options include imposing a tax on emissions from vehicles' tailpipes, toughening existing fuel economy standards, combining "gas guzzler" taxes with rebate schemes giving consumers a financial incentive to purchase more fuel-efficient vehicles, increasing subsidies for alternative fuels, raising gasoline taxes, and launching programs rewarding people for removing older vehicles from the road.

Tailpipe Emissions Policies

Under the 1965 Clean Air Act Amendments, the federal government regulates emissions from vehicles' tailpipes. Standards limit the emission of hydrocarbons, carbon monoxide, oxides of nitrogen, and particulates. Under 1970, 1977, and 1990 amendments to the act, the Congress made the standards increasingly more stringent. The Clean Air Act Amendments of 1990, for example, placed additional restrictions on emissions from new light-duty vehicles, effective in the mid-1990s. The 1990 amendments also require cleaner fuels and fleet vehicles that use cleaner fuels to be sold in certain areas.

Some states are beginning to adopt measures to supplement federal controls over tailpipe emissions. California, for example, has set tailpipe emissions standards for gasoline-fueled vehicles that are, in most cases, more stringent than federal requirements through 1994 and has developed a clean car/clean fuel program, scheduled to begin in 1994. Under this program, manufacturers will be required to meet an average emissions target for their fleets; they may do so by manufacturing any combination of low-emissions vehicles, along with a required percentage of vehicles that produce no emissions. According to the California Air Resources Board, California law does not require that low- or zero-emissions vehicles use alternative fuels. However, such vehicles, including electric vehicles, may be used to meet required standards. The Clean Air Act Amendments

permit states with poor air quality to adopt California's emissions standards. Several states have signed an agreement to do so.

A tax on tailpipe emissions is another means of addressing the external costs of gasoline consumption by light-duty vehicles. The California Air Resources Board is studying a tax on tailpipe emissions as part of a research project evaluating several market-based transportation control measures. Regarding the tailpipe tax, the project will explore ways to measure emissions, minimize the impact of the tax on low-income groups and businesses, and use the tax revenue and will evaluate the tax's likely impact on congestion.

Corporate Average Fuel Economy Standards

In 1975, responding to the oil price shock of 1973-74, the Congress passed the Energy Policy and Conservation Act (EPCA), which established Corporate Average Fuel Economy (CAFE) standards to reduce gasoline consumption in new light-duty vehicles. These standards required that new vehicles from each manufacturer's stock meet an average fuel economy of 18 miles per gallon in 1978, increasing gradually to 27.5 miles per gallon by 1985.[1]

No other country currently sets mandatory fuel economy standards for its vehicle manufacturers. To cope with the oil price shocks in the 1970s, some countries with automobile industries established mandatory or voluntary targets for fuel economy to reduce petroleum consumption. However all of these countries, except Canada, set expiration dates for the standards—1986 or earlier. Even without their own rules, though, foreign automobile manufacturers usually meet the U.S. standards, since the United States is a major world market for light-duty vehicles and all vehicles sold in this country must meet its CAFE standards or pay a fine.

Higher or Modified CAFE Standards Debated

The transportation sector's continuing dependence on oil, the negative impact of gasoline consumption on the nation's air quality, and growing concern about global warming have increased interest in the Congress in raising CAFE standards. For example, a fuel economy bill (S. 279) was introduced in the 102nd Congress calling for a 40 percent increase in each company's average fleet fuel economy (above a 1988 baseline) by 2001. However, because of conflicting views about the need for higher

[1]At the request of Ford and General Motors, the Administrator, National Highway Traffic Safety Administration (NHTSA), temporarily reduced the standards to 26.0 miles per gallon for model years 1986-88, in light of the dramatic decline in oil prices around then. The standards were also reduced to 26.5 miles per gallon for model year 1989.

standards, the comprehensive energy legislation now being considered by the Congress (H.R. 776) has no provision to increase the standards. The administration has opposed higher CAFE standards, arguing that they are costly and ineffective.

Some groups have proposed basing CAFE standards on a vehicle's interior volume, in order to reduce the costs of meeting the standards for manufacturers of larger vehicles. Under this scheme, different standards would be required for different-sized vehicles. According to the National Academy of Sciences, meeting the current standards is costly for manufacturers of larger vehicles because these vehicles are less fuel-efficient than smaller vehicles.[2]

While CAFE standards have not been raised since 1985, they have been modified to address air pollution. In 1988 the Congress passed the Alternative Motor Fuels Act to encourage the development and use of alternative fuels and alternative-fuel vehicles. One provision of the act permits manufacturers, beginning with model year 1993, to increase their fleets' average fuel economy ratings, which are used in meeting CAFE standards, depending on how many alternative-fueled vehicles they build. A separate DOE regulation also allows manufacturers to increase their average fleet fuel economy ratings by producing electric vehicles.

Gas Guzzler Taxes

In 1978 President Carter completed his national energy plan, consisting of five separate pieces of legislation. One of these laws, the Energy Tax Act of 1978, established the Gas Guzzler Tax. The tax was designed to complement CAFE standards by further discouraging the production and use of fuel-inefficient vehicles and, ultimately, to decrease the transportation sector's dependence on oil. To achieve this end, the act set a graduated tax schedule applicable to new vehicles that were 5 or more miles per gallon less fuel-efficient than CAFE standards required. The tax was first applied to model year 1980 vehicles, and the law set designated tax rate increases through 1986. The Revenue Reconciliation Act of 1990 doubled the Gas Guzzler Tax rates.

Economists debate the merits of the Gas Guzzler Tax in reducing gasoline consumption and the nation's vulnerability to oil price shocks. According to some analysts, the point at which the tax begins to apply is too low—22.5 miles per gallon—because it is below the average fuel economy

[2]Automotive Fuel Economy: How Far Should We Go?, National Research Council, Washington, D.C. (1992). The National Research Council is the principal operating agency of the National Academy of Sciences.

level of most new vehicles. As such, it applies primarily to luxury or high-performance vehicles, which comprise a very small percentage of U.S. automobile sales.

Some states have recently proposed taxes similar to the Gas Guzzler Tax to further reduce gasoline consumption. For example, the Maryland General Assembly recently enacted a law that not only taxes fuel-inefficient vehicles but also provides a financial rebate to consumers who purchase fuel-efficient vehicles. Proponents of this type of "fee-rebate" program contend that it would further encourage the use of fuel-efficient vehicles while discouraging the use of fuel-inefficient ones, with the rebates funded by the fees collected. Under Maryland's fee-rebate program, beginning with model year 1993, buyers of new vehicles would pay a $100 surcharge on titling taxes for vehicles averaging fewer than 21 miles per gallon. A $50 rebate would be given to buyers of vehicles that average more than 35 miles per gallon.[3]

California has drafted a fee-rebate proposal that would impose a graduated sales tax surcharge on fuel-inefficient, polluting vehicles and use the revenues generated to fund reductions of the sales tax imposed on vehicles that are fuel efficient and emit fewer pollutants. According to California officials, the California legislature passed legislation for this program in 1990, but the bill was vetoed by the Governor. The bill was reintroduced in 1991 but was rejected at the committee level. In 1992 the fee-rebate proposal was not introduced in committee because support from affected agencies came too late, after close of the legislative calendar.

At the federal level, two bills containing fee-rebate proposals (H.R. 1583 and H.R. 2960) were introduced during the 102nd Congress. Both bills were designed to combat global warming by reducing carbon dioxide emissions from vehicles and the nation's vulnerability to oil price shocks by encouraging the purchase of more fuel-efficient vehicles and discouraging the purchase of fuel-inefficient vehicles. One bill (H.R. 2960) also incorporated incentives to reduce emissions of ozone-forming pollutants, emissions of air toxics, and carbon monoxide by providing credits for vehicles that operate exclusively on alternative fuels with net

[3]The law is currently being challenged by NHTSA. Federal CAFE standards, according to NHTSA, preempt states from adopting any law that "relates to" fuel economy standards. In response, the Maryland Attorney General ruled that Maryland's fee-rebate program was not preempted. However, the Attorney General stipulated that Maryland's law could not be implemented until the deletion of a preempted consumer notice provision in the law requiring manufacturers to show the vehicle's fuel economy on a sticker.

air quality benefits. However, neither the House of Representatives nor the Senate included a fee-rebate proposal in its omnibus energy legislation during the 102nd Congress.

Alternative-Fuel Policies

Various events have spurred the United States to reduce its dependence on oil by finding alternatives to gasoline for light-duty vehicles. For example, the energy crises in the 1970s increased interest in petroleum substitutes, such as ethanol, methanol, and natural gas.

The federal government and some states have adopted policies to promote the use of alternative fuels. Under the Energy Tax Act of 1978, the federal government provided a 4 cents per gallon exemption from the federal gasoline tax for fuels containing 10 percent or more alcohol. The exemption currently applies to ethanol blends and is 5.4 cents per gallon through 2000, as set by the Omnibus Budget Reconciliation Act of 1990. In addition, some states exempt certain alternative fuels from all or part of the state gasoline tax.

Additionally, the federal government adopted the Alternative Motor Fuels Act of 1988 to encourage the use of methanol, ethanol, and compressed natural gas. The act requires, among other things, that the maximum practical number of light-duty vehicles in the federal fleet be alternative-fuel vehicles.

Federal policies promoting alternative fuels have also been introduced to address environmental costs. For example, the Clean Air Act Amendments of 1990 encourage the adoption of cleaner fuels, with the expectation that some of these fuels may be alternative fuels. The amendments require "cleaner" fuels and "clean" fleet vehicles to be sold in the mid-1990s in areas with poor air quality.[4] Additionally, President Bush signed Executive Order 12759 in April 1991 requiring, subject to availability of appropriations, increased use of alternative-fuel vehicles in the federal fleet to address air quality concerns, and for other reasons.

The administration has also proposed research and development programs to develop cleaner fuels and vehicles. For example, under the United States Advanced Battery Consortium, the federal government and U.S. automobile manufacturers are developing batteries for electric vehicles

[4]Reformulated gasoline used in vehicles with improved emissions control systems will likely be "clean" enough to meet the 1990 Amendments' requirements and California clean vehicle standards, at least through the mid-1990s. Reformulated gasoline is produced by changing the concentration of one or more components of conventional gasoline to reduce emissions levels.

that further improve cost and performance. Electric vehicles have essentially no tailpipe emissions.

The 102nd Congress is considering comprehensive energy policy legislation that includes alternative-fuel provisions. This legislation would, among other things, provide tax deductions for buying vehicles that use clean-burning fuels. It would also provide a tax benefit for electric vehicles and broaden existing tax breaks for gasoline blended with ethanol.

International Alternative-Fuel Policies

The 1970s oil crises also sparked international interest in adopting policies to increase use of alternative fuels to reduce petroleum consumption. For example, the Brazilian government provided substantial subsidies for ethanol production and directed the government-owned oil company to provide ethanol fueling facilities and to keep gasoline prices higher than ethanol prices. The Canadian government has provided grants to consumers who converted their vehicles to run on propane or natural gas. New Zealand provided financial incentives to consumers for converting vehicles to run on natural gas or propane and to industry for developing a fueling network. However, consistent, long-term government commitment has been somewhat difficult to maintain because of resource constraints and other reasons. Failure to maintain this commitment, in some cases, had a strong negative impact on sustaining the use of alternative fuels.[5]

Gasoline Taxes

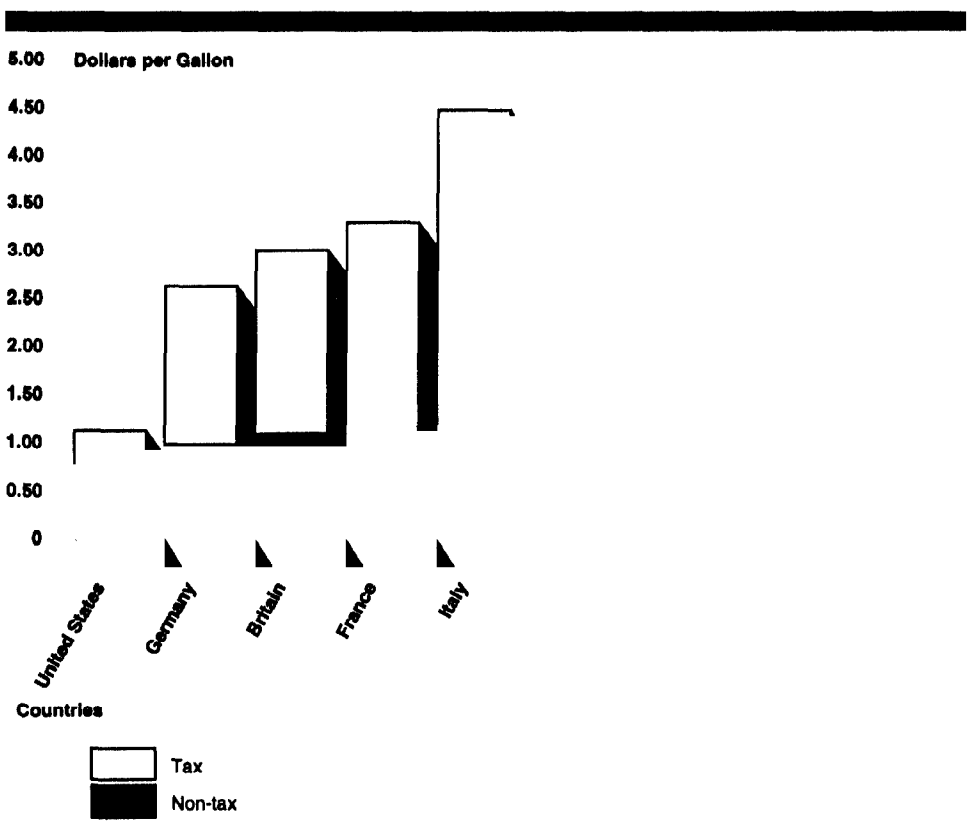
The U.S. federal government has imposed gasoline taxes since 1932. The taxes were instituted initially to address a federal budgetary imbalance resulting from the severe depression of the 1930s. Originally set at 1 cent per gallon, over time the tax has been gradually raised to the current 14.1 cents per gallon. During this time the tax has been used for various funding purposes, including to meet national defense requirements during World War II and the Korean War, to help fund construction of the nation's interstate and highway systems and to provide capital and operating funds for mass transit systems. A small portion of the current tax is used to reduce the federal deficit and to fund cleanup of underground storage tanks that leak petroleum products.

Taxes on gasoline in Western Europe and Japan are much higher than in the United States. As of April 1991 the tax component of U.S. gasoline retail prices was about 15 percent of the average of the four major

[5]Alternative Fuels: Experiences of Brazil, Canada, and New Zealand in Using Alternative Motor Fuels (GAO/RCED-92-119, May 7, 1992).

European countries. The total U.S. tax rate was around $0.36 per gallon, compared with $1.64 in Germany, $1.91 in Britain, $2.33 in France, and $3.26 in Italy. The tax comprises most of the per gallon retail gasoline price these Europeans pay. Figure 2.1 depicts the differences in gasoline taxes and retail gasoline prices in the United States and four major European countries.

Figure 2.1: Tax and Nontax Portions of Retail Gasoline Prices in Selected Countries, April 1991



Source: Cambridge Energy Research Associates.

Higher federal gasoline taxes have recently been proposed as a means to reduce gasoline consumption and emissions as well as reduce the federal deficit. For example, a federal gasoline tax increase was considered for inclusion in the 1991 National Energy Strategy as an option to meet two of the strategy's three broad objectives—protecting the environment and

decreasing the nation's vulnerability to oil price shocks. However, the President's Economic Policy Council, Cabinet-level advisors involved in developing the strategy, rejected the increase because they believed it would cause slower economic growth. Maintaining a healthy economy was the third broad objective of the strategy.

During the 102nd Congress, several bills proposed increasing gasoline taxes to help reduce the federal budget deficit. However, the Congress has not increased the gasoline tax since 1990, when a 5-cent increase was passed under the Revenue Reconciliation Act, part of which was earmarked for deficit reduction.

In 1919 Oregon adopted an excise tax on gasoline—the first state to do so. All fifty states and the District of Columbia now assess taxes on gasoline, averaging about 22 cents per gallon. In 1990 California passed a tax increase plan whereby the gasoline tax would increase by 5 cents during the first year and 1 cent per year thereafter to a total increase of 9 cents. Portions of the revenues will fund programs to improve air quality.

Vehicle Scrappage Programs

Older vehicles contribute a disproportionate share of the air pollution created by light-duty vehicles and are among the most fuel-inefficient vehicles on the road. According to the National Academy of Sciences, the most critical problem associated with motor vehicle emissions is the increase in emissions as vehicles age.[6] Another study reports that pre-1971 vehicles account for only 1.7 percent of the total vehicle miles traveled in the United States, but produce about 5 percent of NOx, 7 percent of hydrocarbon, and 7.5 percent of carbon monoxide emissions nationwide. Additionally, older vehicles, manufactured before CAFE standards took effect or during the early phases of their implementation, are likely to be less fuel efficient than newer vehicles. Because of their fuel inefficiency, these vehicles are also sources of carbon dioxide, a major greenhouse gas.

Vehicle scrappage programs are one way to remove older vehicles from operation. Under these programs, owners of older, currently registered vehicles who voluntarily retire their vehicles receive a financial reward. The reward applies to all qualifying vehicles produced before a given year.

The administration suggested in its 1991 National Energy Strategy that state and local governments and private entities consider adopting vehicle

[6]Rethinking the Ozone Problem in Urban and Regional Air Pollution, National Academy Press, Washington, D.C., 1991, p. 13.

scrappage programs as a means of helping to achieve clean air goals. The NES estimated that such programs could remove 2 million vehicles from operation by the year 2000, saving 10,000 to 15,000 barrels of oil per day and reducing emissions that produce smog by 1 to 2 percent. The administration is currently developing guidance for governments and industry to follow to design vehicle scrappage programs to meet emissions standards set by the Clean Air Act.

Unocal Corporation, an oil company based in California, implemented a vehicle scrappage program in Los Angeles in 1990. By providing a $700 bounty to owners who retired their pre-1971 vehicles, Unocal removed 8,376 of these vehicles from operation. The company estimated that pre-1971 vehicles accounted for about 15 percent of all emissions from mobile sources in the Los Angeles basin, emitting, on average, 11 times more NOx, 56 times more carbon monoxide, and 99 times more hydrocarbons than new 1990 vehicles. According to Unocal, the program reduced annual air pollution in southern California by nearly 13 million pounds.

Policy Options Vary in Their Effectiveness in Reducing External Costs and Meeting Other Policy Objectives

The six policy options we reviewed could all reduce the nation's dependence on oil and vulnerability to oil price shocks, but none of the six meet all of the policy objectives we identified. For example, while a higher gasoline tax and a tailpipe emissions tax could reduce air pollution from new and old vehicles and traffic congestion, they could also slow economic growth and impose disproportionate costs on low-income groups. Fee-rebate programs and subsidies for alternative fuels might not have these drawbacks, but neither would relieve traffic congestion.

Table 3.1 summarizes our analysis of the six policy options and highlights associated trade-offs. Because trade-offs have not been quantified, their relative magnitudes are not indicated. In addition, tradeoffs depend in part on the expected size of the option evaluated. For example, alternative fuel subsidies and a vehicle scrappage program may not slow economic growth because their size may be limited by budget deficits.

Table 3.1: Evaluation of Policy Options

		Policy options					
Policy objectives	**The policy option is likely to result in:**	**Higher gasoline tax**	**Tailpipe emissions tax**	**Subsidies for alternative fuels**	**Higher CAFE standards**	**Fee-rebate program for new vehicles**	**Old-vehicle scrappage program**
Environmental quality	Less air pollution from new vehicles	Y	Y	?	?	Y	N
	old vehicles	Y	Y	?	N	N	Y
	Greater reductions in the more harmful pollutants in a cost-effective manner	N	?	N	N	N	N
	Increased R&D in less polluting fuels and/or vehicles	?	Y	Y	?	Y	N
Petroleum conservation	Less gasoline consumed in new vehicles	Y	Y	Y	Y	Y	N
	old vehicles	Y	Y	Y	N	N	Y
	More use of mass transit	Y	Y	N	N	N	?
	More use of alternative fuels	Y	Y	Y	?	Y	N
	Increased R&D in ways to reduce gasoline consumption	Y	Y	Y	Y	Y	N

(continued)

Policy objectives	The policy option is likely to result in:	Policy options: Higher gasoline tax	Tailpipe emissions tax	Subsidies for alternative fuels	Higher CAFE standards	Fee-rebate program for new vehicles	Old-vehicle scrappage program
Security from oil price shocks	Reduced dependence on oil	Y	Y	Y	Y	Y	Y
Relief from traffic congestion	Less traffic congestion	Y	Y	N	N	N	Y
Equity	No disproportionate costs imposed on individuals in low-income or rural populations	N	N	Y	Y	Y	N
Economic growth	No slowdown in economic growth	N	N	Y	?	?	Y
Competitiveness	No more costs imposed on domestic firms than on similar firms based in other countries	N	N	Y	N	N	Y
Visibility of costs	Costs that are visible to consumers	Y	Y	N	N	Y	?
Administrative feasibility	No large increase in administrative difficulty	Y	N	?	Y	?	?

Legend: Y= yes; N= no; ?= indeterminate.

Higher Federal Gasoline Tax

Increasing the federal gasoline tax would reduce gasoline consumption, and with it emissions of air pollutants and greenhouse gases from gasoline-powered vehicles. Lower consumption would reduce the nation's dependence on oil and vulnerability to oil price shocks. On the other hand, a higher gasoline tax could mean slower economic growth and may be regressive in that the burden of costs could fall disproportionately on low-income groups.

Advantages

A higher tax could reduce gasoline consumption, air pollution, and greenhouse gases from new and old vehicles using that fuel. Consumers could respond to this tax by maintaining their cars better, driving less and at lower speeds, traveling by mass transit or in car pools, and buying more fuel-efficient vehicles. A higher tax could also encourage greater use of

alternative fuels and could reduce dependence on oil and attendant vulnerability to oil price shocks. However, an eventual increase in the use of certain alternative fuels that also produce undesirable emissions could offset some of the environmental gains from less gasoline consumed.

A higher tax could relieve highway congestion by encouraging some people to use other forms of transportation, such as mass transit, or to share rides with other commuters.

Disadvantages

A substantially higher gasoline tax, such as those imposed by some European countries, could have a negative short-term impact on the economy in the absence of other offsetting changes to fiscal or monetary policy. By increasing the price of gasoline, a higher tax would reduce consumers' disposable income. Higher fuel prices would also increase costs for businesses using gasoline-powered light-duty vehicles. As a consequence, economic growth could slow.

Moreover, because gasoline expenditures for some consumers in low-income groups may represent a larger percentage of total expenditures than for consumers in higher-income groups, these individuals could bear a disproportionate share of any increase in higher gasoline prices or driving costs. A higher tax could also affect rural regions disproportionately because driving distances tend to be greater and fewer alternatives to driving exist.

Tailpipe Emissions Tax

A tailpipe tax could be designed to achieve greater reductions in some pollutants than in others and it could be based on the damages they cause and costs of reduction. Thus, it could encourage greater consumption of less polluting fuels. Such a tax could also be designed to encourage drivers to drive fewer miles, or improve their vehicle's fuel efficiency or emissions control equipment, further reducing gasoline consumption. A tailpipe tax, however, could be administratively complex. Furthermore, like a gasoline tax, the tailpipe tax could slow economic growth and could be regressive. As noted in chapter 2, the tailpipe tax has not been implemented in the United States, but it is under consideration in California.

Advantages

A tailpipe emissions tax could reduce pollution from new and old vehicles alike. To the extent that it can be designed to tax different pollutants according to their relative harm, it could also be more cost effective in

reducing particular kinds of pollution than a gasoline tax, which cannot differentiate between pollutants. Moreover, unlike a gasoline tax, the tailpipe tax could tax emissions of any fuel. Under a tailpipe emissions tax, automobile owners could also be taxed according to annual miles driven, not just on the emissions characteristics of their vehicles. Pollutants emitted from the tailpipe, such as carbon monoxide and hydrocarbons, could be taxed according to the amount emitted and miles driven.[1] Carbon dioxide emissions could be reduced because the tax could encourage consumers to improve their vehicles' fuel economy levels and purchase more fuel-efficient vehicles.[2]

A tailpipe emissions tax has the potential to be the least costly option for reducing emissions to the extent that it can be designed to achieve higher reductions of the more damaging pollutants from lower-cost sources. For example, emissions could be reduced substantially if vehicles that are the worst polluters traveled fewer miles (e.g., even a small reduction in miles traveled by these vehicles would provide large benefits in reduced pollutants). Drivers of these vehicles—older or poorly maintained vehicles—and drivers who drive more than average would have the greatest incentive to reduce emissions if they were taxed more heavily than other drivers. Heavily taxed drivers could reduce emissions in several ways, including by driving less, improving the fuel efficiency of their engines, or maintaining emissions control equipment. This flexibility in how drivers respond to the tax could reduce the cost of their compliance.

If a tailpipe emissions tax stimulated consumer demand for alternative fuels and vehicles that cause less pollution, vehicle manufacturers would have greater incentive to develop these alternatives. Thus, under this policy option, less polluting alternatives, such as electric vehicles, might be commercialized sooner. Although electric vehicles have essentially no tailpipe emissions, they are not yet commercially feasible because they are expensive to operate.[3] A tailpipe emissions tax could encourage consumers to consider using electric vehicles for commuting and shorter trips, while

[1]Ideally, pollutants would be taxed according to the amount emitted and the relative harm they cause. It would be difficult, however, to estimate their relative harm, partly because pollutants have varying effects within airsheds, depending on temperature and ambient air quality. Relatedly, the tailpipe tax would not directly affect hydrocarbons that evaporate from a vehicle's fuel system or a gasoline pump. However, the tax would encourage owners to drive less, which could mean fewer fill-ups and lower evaporative hydrocarbon emissions at the gasoline pump.

[2]Each gallon of gasoline burned emits about 20 pounds of CO2. A tax could also be levied on CO2 emissions.

[3]Total life-cycle emissions from using an electric vehicle, however, depend on the source of power that is used to produce the electricity (for example, coal vs. nuclear).

manufacturers would have greater incentives to invest in developing batteries to increase the range of electric vehicles.

Disadvantages

A tailpipe emissions tax could be difficult to administer because of the complexities involved in measuring tailpipe emissions. The procedure currently used by state emissions inspection programs tests a vehicle's performance during idling conditions. This is not an ideal procedure because emissions vary depending on speed and driving conditions. Furthermore, measuring emissions other than those currently measured—such as carbon monoxide and hydrocarbons—could be costly.

The regulations implementing a tailpipe emissions tax might also be difficult to enforce. Cheating by disabling emissions control equipment after passing inspection could reduce the effectiveness of a tailpipe tax. In California the Senate Office of Research claims that many of the state's "gross polluters" are vehicles whose emissions control equipment has been disabled intentionally after the vehicles passed the annual smog inspection test. It could also be difficult to prevent owners from adjusting odometers to limit mileage recorded.

Like a higher gasoline tax, a tailpipe emissions tax could also slow economic growth in the short term by reducing disposable income and could impose higher costs on low-income groups because it could represent a greater proportion of their income. These groups might be taxed more because individuals in low-income groups typically own older vehicles that pollute more, and they might not be able to afford to buy new vehicles or modify their existing vehicles to reduce emissions and avoid a heavy tax.

Rural populations might also be disproportionately affected by a tailpipe emissions tax. They might not be able to reduce the number of miles they travel in light-duty vehicles because they have fewer alternatives, such as public transportation systems, than individuals in urban areas.

Increased Subsidies for Alternative Fuels

Like a gasoline tax, an increase in subsidies for alternative fuels could reduce gasoline consumption and, thus, the nation's dependence on oil and vulnerability to oil price shocks. This option, however, might provide

only limited environmental benefits and, depending on the success of specific fuels or blends, could make some types of pollution worse.[4]

Advantages

By reducing the price of alternative fuels relative to gasoline, some subsidies, such as an exemption of alternative fuels from motor fuel taxes, could encourage some consumers to substitute alternative fuels for gasoline and alternative-fuel vehicles for gasoline-powered ones, thus reducing gasoline consumption. Other types of subsidies, such as tax credits for individuals who purchase alternative-fuel vehicles or retrofit an older vehicle, could also lead to lower consumption of gasoline. In addition, as discussed below, use of some alternative fuels could reduce certain types of emissions.

Other Effects

The impact of a subsidy for alternative fuels on air quality[5] is uncertain because alternative fuels have different emissions characteristics. For example, use of compressed natural gas (CNG), methanol, and ethanol could lower emissions of nonmethane hydrocarbons and carbon monoxide. On the other hand, use of CNG or methanol may not yield significant reductions in NOx. Use of methanol could also lead to increases in vehicle emissions of formaldehyde (HCHO), which could raise slightly ambient HCHO in winter months and HCHO levels in parking structures and tunnels in summer months. Increased use of ethanol could lead to the formation of peroxyacetyl nitrate (PAN). On the other hand, increased use of alternatives such as electricity and hydrogen could reduce emissions of hydrocarbons, carbon monoxide, and NOx.

As illustrated in table 3.2, total (or life-cycle) greenhouse gas emissions of alternative fuels also vary depending on the feedstock used to produce the fuel. For example, methanol or CNG produced from natural gas could lower greenhouse gas emissions. Similarly, ethanol, methanol, and synthetic natural gas made from woody material could lower greenhouse gas emissions partly because carbon dioxide emissions released could be

[4]One difficulty in evaluating alternative fuel subsidies is that, unlike the other options we evaluated, this option can take many different forms. It could be fuel neutral, an example being a tax credit or deduction for the purchase of an alternative-fuel vehicle. Or, it could be fuel specific, an example being a lower motor fuels tax on a particular alternative fuel. For purposes of this analysis, we evaluated a fuel-neutral subsidy.

[5]This report assesses air quality in terms of emissions of carbon monoxide, hydrocarbons, and NOx. Interaction of emissions of hydrocarbons and NOx in the lower atmosphere (troposphere) contributes to the formation of ozone. EPA has established ambient air quality standards for six compounds—particulate matter, sulfur dioxide, carbon monoxide, nitrogen dioxide, ozone, and lead. Impact on greenhouse gas emissions is also evaluated.

absorbed by the additional vegetation planted to expand or replenish the feedstock. On the other hand, ethanol, methanol, and CNG, when produced from coal, could increase greenhouse gas emissions. Similarly, ethanol made from corn could increase greenhouse gas emissions because additional nitrous oxide could be released from fertilized soils. Further, additional carbon dioxide could be released during conversion of corn to ethanol, depending on the type and source of energy used to promote fermentation. For example, using coal to fuel the conversion process could add to greenhouse gas emissions. Greenhouse gases from using electric vehicles would also depend on the fuel used to generate electricity. Electric vehicles supplied with power from coal-fired generators could mean increased carbon dioxide. On the other hand, electricity from nuclear or solar power could substantially lower carbon dioxide emissions.

Table 3.2: Greenhouse Gas Emissions From Alternative Fuels, Depending on Feedstock

	Alternative fuels and feedstock					
	Ethanol produced from corn	Ethanol, methanol, synthetic natural gas produced from woody material	Ethanol, methanol, synthetic natural gas, electricity produced from coal	Methanol, compressed natural gas produced from natural gas	Electricity produced from solar or nuclear energy	Hydrogen produced from solar or nuclear energy
Use of the fuel will likely lead to reduced emissions of greenhouse gases	Indeterminate	Yes	No	Yes	Yes	Yes

Note: Greenhouse gases include emissions of carbon dioxide, methane, and nitrous oxide. Greenhouse gas emissions from electric vehicles using coal as feedstock depend partly on the efficiency of the vehicle.

The environmental benefits of using alternative fuels also depend on how the fuels are used. For example, some flexible-fueled vehicles are designed to operate on gasoline or M85 (85 percent methanol and 15 percent gasoline). The use of M85 in these vehicles could reduce hydrocarbon emissions. Drivers of flexible-fueled vehicles, however, may alternate fill-ups with gasoline or M85, depending on price and availability. Certain blends of gasoline and methanol (or ethanol) can increase hydrocarbon emissions. For example, one study indicates that blending gasoline with

less than 80 percent methanol produces more evaporative hydrocarbons than gasoline.[6]

Most proposals for subsidizing alternative fuels, as discussed in chapter 2, involve tax breaks of some kind. The revenue shortfall that would result from these tax breaks might have to be funded through cuts in other programs or through increases in other taxes. For the most part, these would not be visible to consumers of alternative fuels.[7] In addition, the fact that alternative fuel subsidies can take many forms also makes it difficult to judge the administrative ease of implementing this option.

Higher Corporate Average Fuel Economy (CAFE) Standards

Higher CAFE standards could reduce gasoline consumption and greenhouse gas emissions from new vehicles subject to the higher standard. CAFE, however, would not result in reductions from older vehicles not subject to the higher standard. Higher CAFE standards could also impose higher costs, especially on some domestic auto makers that produce a full line of vehicles. Firms that specialize in producing small, fuel-efficient vehicles, including firms based in other countries, could achieve higher fuel economy at lower costs. Furthermore, unlike higher gasoline taxes, the costs of higher CAFE standards are largely hidden from consumers, which may in part explain their popularity in the United States.

Advantages

If higher CAFE standards, similar to those considered recently by the Congress, were established, new vehicles would likely be more fuel efficient and emit less carbon dioxide (since gasoline consumption and carbon dioxide emissions are directly related).

The effectiveness of higher CAFE standards, however, would be reduced if gasoline prices remain low. With low gasoline prices, consumers might be less willing to purchase more fuel-efficient vehicles. In addition, any savings in gasoline consumption (and any consequent reduction in carbon dioxide emissions) will be partially offset if people travel more because of improved fuel efficiency. Increased fuel economy reduces the cost of

[6]Gasoline that is reformulated to reduce volatile and toxic emissions contains oxygenates such as ether or alcohol (up to 15 percent). The addition of oxygenates to gasoline can reduce carbon monoxide emissions. EPA has directed some metropolitan areas to use such blends to reduce carbon monoxide during the winter. On the other hand, the addition of oxygenates like alcohol (ethanol or methanol) can also raise the vapor pressure of gasoline and increase evaporative emissions. Although the impact of reformulated gasoline on air quality is uncertain, one study suggests that reformulated gasoline could be effective at reducing emissions of ozone-forming gases.

[7]Given that gasoline prices are relatively low, the subsidies program might have to be fairly substantial to achieve widespread use of alternative fuels.

operating a vehicle, thus encouraging more driving. According to some research, increased driving would reduce fuel savings from higher CAFE standards by 5 to 15 percent.

Fuel economy improvements in new vehicles could also be limited to the extent that manufacturers produce alternative fuel vehicles to earn CAFE credits, credits that reduce the average fuel economy standard for their gasoline powered fleet, as allowed by the Alternative Motor Fuels Act of 1988. That is, manufacturers might find it cheaper to produce and sell alternative-fuel vehicles, and receive CAFE credits, than to improve the fuel economy of gasoline-powered vehicles. While less gasoline would be consumed if more alternative fuels were used, some increases in gasoline consumption could result from less fuel-efficient gasoline-powered vehicles.[8]

Disadvantages

Gasoline consumption and carbon dioxide emissions from older vehicles, which would not be subject to the new standards, would not decrease. In addition, some U.S. full-line manufacturers (makers of larger, less fuel-efficient vehicles) could be at a disadvantage compared to other firms, including companies that specialize in making smaller fuel-efficient vehicles and whose manufacturing operations are in other countries, in meeting higher CAFE standards. In fact, the National Research Council has cited this reasoning in stating that the current CAFE system has favored some foreign firms that specialize in producing smaller vehicles.[9] Any additional cost of improving the average fuel economy of a fleet, including larger, less fuel-efficient vehicles, could be higher than for a fleet consisting of smaller, more fuel-efficient vehicles.

The costs of higher CAFE standards would be hidden from consumers. Manufacturers would incur any higher costs of making fuel economy improvements, some of which would be passed on to consumers in higher vehicle prices. However, consumers might not associate higher prices with higher standards, since many factors influence the price of vehicles. Depending on the magnitude of any higher costs, economic growth could be affected.

[8]In addition, by lowering operating costs of new vehicles, it is possible that higher CAFE standards could also lead to higher emissions of criteria pollutants, according to one study. If new vehicles are designed to meet EPA's grams-per-mile emissions standards for carbon monoxide, hydrocarbons, and NOx, any increase in miles traveled as a result of higher CAFE standards could result in greater emissions from these vehicles, even though they still met EPA's per-mile standards.

[9]Automotive Fuel Economy: How Far Should We Go?, National Academy Press, Washington, D.C., 1992, pp. 170 and 181.

Higher prices for new vehicles, though, might influence some consumers to hold onto their older, less fuel-efficient vehicles longer than they otherwise would, increasing gasoline consumption and emissions.

Fee-Rebate Programs

Like CAFE standards, a fee-rebate program designed to provide rebates to purchasers of fuel-efficient vehicles and charge purchasers of fuel-inefficient vehicles, would affect new vehicles, reducing gasoline consumption and carbon dioxide emissions by these vehicles.[10] Unlike CAFE standards, fee-rebates would directly increase consumer demand for fuel-efficient new vehicles. In addition, a fee-rebate program, designed to improve emissions as well as fuel economy, could be effective at reducing air pollutants from new vehicles. However, this option would not reduce gasoline consumption and emissions from older vehicles because it does not apply to them. Furthermore, unlike a gasoline tax, the fee-rebate option would not likely reduce highway congestion.

Advantages

By reducing the price of vehicles that are more fuel-efficient and pollute less, and raising the price of vehicles that are less efficient and pollute more, fee-rebate programs could encourage consumers to purchase cleaner, more fuel-efficient vehicles. Thus, they could be more effective at improving the fuel efficiency of new vehicles than higher CAFE standards, which provide no direct financial incentives for consumers to buy more fuel-efficient, less polluting vehicles. As a result, gasoline consumption and carbon dioxide emissions could fall.

Disadvantages

In contrast to gasoline taxes, however, a fee-rebate program would not encourage consumers to drive less or maintain their vehicles. Also, fee-rebate programs might reduce the turnover of older vehicles because the prices of some new models will be higher. Consumers who prefer vehicle attributes that are associated with fuel inefficiency, such as size or acceleration, might choose to hold on to their older vehicles longer rather than pay a fee to purchase a comparable new vehicle. This could adversely affect some U.S. full-line manufacturers. The effect this might have on economic growth is unclear.

Attaining better fuel efficiency along with lower emissions could be complicated to the extent that greater fuel economy and better emissions

[10]The fee-rebate program could be designed to be revenue neutral. That is, surcharges on fuel-inefficient and more polluting vehicles would be used to fund rebates and pay administrative costs.

control are not always compatible. For instance, the National Research Council stated recently that achieving emissions control standards such as California's low-emissions-vehicle standards could limit manufacturers' ability to attain higher fuel economy levels.[11]

Because fee-rebate programs do not discourage driving, they would not likely reduce congestion. Furthermore, as with higher CAFE standards, the gains in fuel economy afforded by fee-rebate programs might cause people to increase their driving, offsetting some reductions in gasoline consumption. In addition, fee-rebate programs have not been tested widely enough to judge the administrative difficulties of implementing such a program.

Vehicle Scrappage Programs

In contrast to CAFE and fee rebates, a vehicle scrappage program could accelerate the retirement of older vehicles and could reduce air pollution and greenhouse gases emitted from these vehicles. Older vehicles tend to be less fuel efficient and more polluting. Unlike CAFE and fee rebates, however, a scrappage program would not directly affect fuel efficiency or emissions of new vehicles. Similar to a gasoline or tailpipe tax, a scrappage program could be regressive, meaning disproportionate costs on low-income groups. This would occur to the extent that a scrappage program drove up used vehicle prices.

Advantages

By providing a financial reward to owners who retire vehicles produced before a certain date (for example, 1980), a scrappage program could reduce the disproportionate gasoline consumption and air pollution these vehicles cause. Older vehicles tend to use more fuel and can have higher emissions than newer automobiles. For instance, the National Academy of Sciences has stated that the most critical problem associated with motor vehicle emissions is the increase in emissions as vehicles age.[12] In addition, a scrappage program could reduce highway congestion by removing from use older vehicles that are more likely to break down on the nation's highways.

Disadvantages

Unlike higher CAFE standards and fee-rebate programs, scrappage programs do not affect new vehicles. Furthermore, the savings attained by

[11]Automotive Fuel Economy, p. 76.

[12]Rethinking the Ozone Problem in Urban and Regional Air Pollution, National Research Council, National Academy Press, Wash., D.C., 1991, p. 13.

retiring older vehicles could be undercut somewhat if some owners were to replace scrapped vehicles with other older vehicles, or if some owners were to keep their older vehicles longer to participate in future scrappage programs. According to Unocal, 46 percent of those participating in its scrappage program bought another vehicle; another 42 percent made greater use of another vehicle they already owned; and 8 percent shared rides and used public transportation.

As with a gasoline tax, a vehicle scrappage program could be regressive by imposing disproportionate costs on low-income groups. As older vehicles are scrapped, fewer used vehicles would be available for resale, increasing average resale prices. To the extent that individuals in low-income groups are more dependent on the used-car market, they could be especially hard hit by higher prices. These higher prices would represent a greater share of income for individuals in low-income groups. Like fee-rebate programs, a scrappage program has never been implemented on a large scale, making it difficult to judge the administrative difficulties associated with implementing such programs.

Conclusions

Each of the six policy options we examined for reducing the external costs of gasoline consumption could reduce the nation's dependence on oil and vulnerability to oil price shocks and air pollution. However, all of the options would involve trade-offs because other important policy objectives may not always be met when trying to reduce these external costs of gasoline consumption. Even the two policy options that address more objectives than any of the other options—raising gasoline taxes and instituting a tax on tailpipe emissions—have shortcomings: They could lead to slower economic growth and impose more of a financial burden on low-income groups and rural populations.

Given that these options may not address all important policy objectives, a relevant question is whether they can be modified or combined in a coordinated strategy to meet more of these objectives. This is the subject of the following chapter.

Policy Options Can Be Modified or Combined

None of the policy options discussed in chapter 3 meets all the policy objectives we identified. However, these options could be made more effective in two ways: They could be modified to offset any negative impacts and achieve desired objectives, or they could be combined in a coordinated strategy. Several possibilities are discussed below.

Modifications of Policies

To meet more policy objectives, several options could be redesigned: by redirecting tax revenues to offset any negative effects on economic growth and any disproportionate costs for the poor; by taking advantage of promising new technologies to remedy administrative complexities, and by adopting credit trading, a strategy first used in the environmental area to reduce the costs of complying with regulatory standards.

Recycling Tax Revenue to Improve Economic Growth and Equity

Prospects for economic growth could be improved by using gasoline or tailpipe emission tax revenues to reduce other taxes, such as personal income or payroll taxes. In addition, a portion of the revenue could be earmarked for low-income groups or rural populations to offset the regressivity of higher gasoline or tailpipe taxes.

As noted in chapter 3, without compensating monetary or fiscal policy, higher gasoline or tailpipe taxes could slow economic growth.[1] Some analysts believe, however, that using revenues from higher gasoline or tailpipe emission taxes to reduce other taxes, such as income or payroll taxes, could improve prospects for economic growth. Reducing these other taxes could encourage more savings, work effort, and investment—activities that are critical to long-term economic growth. Thus, using revenue collected from a higher gasoline or tailpipe tax to reduce income or payroll taxes could have an offsetting effect on economic growth, without adding to the budget deficit.

These and other negative aspects of gasoline and tailpipe taxes could also be addressed by gradually phasing them in. In addition, phasing in a gasoline or tailpipe tax over time[2] could soften any short-term impact on

[1]Some modeling studies have predicted a decline in economic growth from higher gasoline taxes. However, there could be a potentially positive effect on economic growth from reducing environmental externalities. For instance, less pollution could lead to higher productivity of the labor force, greater crop and forest yields, and less expense to maintain the nation's infrastructure of roads and buildings.

[2]For example, an inflation-adjusted gasoline tax could start at an initial level and increase annually up to a designated amount.

economic growth and could provide an opportunity to monitor the taxes' impact on the economy and air quality.

Such tax reform could also address the regressivity of gasoline and tailpipe taxes. The higher incidence of these taxes on individuals in low-income groups could be offset by providing these individuals with a proportionately larger reduction in income or other taxes.[3] Similar adjustments might also be necessary to compensate rural residents for higher tax incidence.

The tax changes envisioned would represent a significant transformation of our tax system. As a result, prospects for such reform are problematic. However, other fiscal concerns tied to the budget deficit, estimated at nearly $370 billion for fiscal year 1992, could make such tax reform somewhat more palatable. Some of the revenues collected from higher gasoline and tailpipe taxes could be earmarked for deficit reduction.

Use of New Technology to Reduce Administrative Complexity of Tailpipe Emissions Tax

As discussed earlier, administering the tailpipe emissions tax is complex because the testing equipment currently measures emissions only while a vehicle is idling and does not detect all pollutants. In addition, enforcement is difficult because drivers could tamper with their emissions control equipment in between tests.

However, new technology has been developed that can test vehicles under a wide range of operating conditions and detect more pollutants of concern. EPA has proposed, in response to the 1990 Clean Air Act Amendments, using this technology in improved inspection programs in 80 of the nation's worst areas for smog. Vehicle emissions would be tested during a cycle of typical city driving, including acceleration and braking. The new test would detect oxides of nitrogen, a pollutant not measured by current equipment, in addition to carbon monoxide and hydrocarbons. The test could also measure evaporative emissions from each vehicle.[4]

Technology also exists to deal with some compliance problems. For example, vehicles whose emissions control equipment had been disabled after passing an inspection program could be identified by remote sensing

[3]Because some in these groups pay no income taxes, tax reform could entail the payment of negative income taxes.

[4]Preliminary analysis of the new equipment suggests the test will improve upon traditional testing equipment and fail more vehicles. On the other hand, several factors, including the high cost of the equipment, could limit its use.

devices. Such devices can measure emissions from vehicles as they pass a checkpoint and can photograph license plates. Vehicles emitting too much pollution could be identified and the owners fined. Remote sensing devices are being used in Southern California as part of a study on heavily polluting vehicles and are being considered to enhance inspection programs.

Credit Trading to Decrease Cost of Meeting Higher Fuel Economy Standards

While higher CAFE standards might impose disproportionate costs on automobile manufacturers (including some U.S. manufacturers) that specialize in larger, less fuel-efficient vehicles, these costs could be reduced with a system for trading fuel economy credits. Under such a system, manufacturers that meet CAFE standards at less cost could earn credits by exceeding the standards and then either save the credits for future years or sell the credits to manufacturers that find it more costly to improve the fuel economy of their fleets.[5] Similar credit trading programs have been used to meet ambient air quality standards at less cost.

Combinations of Policies

In some cases, a combination of policy options could more effectively reduce gasoline consumption, air pollutants, and greenhouse gases than any one option alone. Possibilities include combining subsidies for alternative fuels with a tailpipe emissions tax, combining a fee-rebate program or a higher gasoline tax with higher CAFE standards, and combining vehicle scrappage and fee-rebate programs.

Subsidies for Alternative Fuels Combined With Tailpipe Emissions Tax

Subsidies for alternative fuels could be more effective in promoting the use of cleaner alternative fuels and vehicles that run on cleaner fuels if the subsidies were combined with a tailpipe emissions tax. As discussed in chapter 3, some alternative fuels may increase emissions of certain pollutants, and alternative fuel blends may not always improve air quality. Yet cleaner alternatives, such as electricity and hydrogen, are not commercially feasible at present because they are expensive to produce and operate. By increasing the cost of using fuels and vehicles that pollute, a tailpipe emissions tax could encourage consumers to purchase alternatives that cause less pollution. If cleaner alternatives were not

[5]Other modifications to CAFE have been proposed to improve its effectiveness. These proposals include interior volume-based average fuel economy (VAFE) and uniform-percentage increase average fuel economy standards. Under VAFE, manufacturers would improve fuel economy levels on the basis of the size of various models. The uniform-percentage standard would require manufacturers to improve fuel economy levels on the basis of each manufacturer's average fuel economy level in a base year.

available, demand for such alternatives could spur manufacturers to develop them. Under a combination of subsidies for alternative fuels and a tailpipe emissions tax, then, government subsidies and private investment could bring cleaner alternatives to the marketplace—perhaps more quickly than if either policy were implemented alone.[6]

Higher CAFE Standards Combined With Fee-Rebate Program or Higher Gasoline Tax

Higher CAFE standards combined with a fee-rebate program or a higher gasoline tax could increase the demand for more fuel-efficient vehicles. As noted in chapter 3, CAFE standards require that manufacturers produce and sell vehicles with fuel economy levels that may be higher than consumers desire at low gasoline prices. Relatively low gasoline prices encourage consumers to choose attributes such as vehicle size and engine performance that are associated with fuel inefficiency. As a result, higher fuel economy standards may be less effective when gasoline prices are low. Furthermore, higher standards can be costly to manufacturers because consumers may avoid buying the fuel-efficient vehicles manufacturers must sell to meet the standards. A fee-rebate program or higher gasoline taxes could complement higher CAFE standards by providing the financial incentive consumers would need to purchase more fuel-efficient vehicles and avoid fuel-inefficient vehicles.

Vehicle Scrappage Program and Fee-Rebate Program Combined

Combining a vehicle scrappage program and a fee-rebate program could reduce gasoline consumption and consequent pollution from both old and new vehicles. Alone, a vehicle scrappage program would affect only older vehicles, and a fee-rebate program only new vehicles. Together, these programs could increase use of newer, more fuel-efficient vehicles that pollute less and remove from the road the older vehicles that pollute more and consume more fuel. A combination of the two programs could be designed so that the fees charged on sales of the less fuel-efficient vehicles could be used to fund rebates for sales of newer, more fuel-efficient vehicles that cause less pollution and to provide a bounty to automobile owners who voluntarily retire their older vehicles.

Conclusions

Policy options could be modified or combined with other policy options to more effectively reduce gasoline consumption and air pollutants from light-duty vehicles and to meet other important policy objectives. Options that send consumers clear market signals, such as higher gasoline or

[6]In addition, the size of the alternative fuels subsidy might not have to be as large, to encourage use of cleaner fuels, than if it were implemented alone.

tailpipe taxes, could help ensure that the costs of gasoline use in light-duty vehicles are visible and fully considered by consumers when they make decisions about purchasing, maintaining, driving, and retiring vehicles. Options that send clear market signals adopted in combination with existing or proposed programs, such as current CAFE standards or pending legislative requirements for the use of alternative-fuel vehicles, could increase the demand for more fuel-efficient and alternatively-fueled vehicles.

Relying on a single option to address the external costs of gasoline consumption can come at a cost. Other policy objectives, like economic growth or administrative feasibility, may not be met. In turn, this could limit the chance that any one option will be adopted. An eclectic strategy combining the best designs of individual policy options may be the best way to meet multiple policy objectives.

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